ROAD ENGINEERING ASSOCIATION
OF ASIA & AUSTRALASIA

JOURNAL

PP 7021/8/93

No.3

ROAD ENGINEERING ASSOCIATION OF ASIA & AUSTRALASIA

Journal

January 1994

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JOURNAL

Publisher

– *THE ROAD ENGINEERING ASSOCIATION OF ASIA & AUSTRALASIA*
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P.J. Industrial Park, Jalan Kemajuan
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Selangor, Malaysia

Tel: 03-7571159
Fax: 03-7575011

Printer

– *Percetakan Bahagia*
3 Jln. Jejaka Dua, Tmn. Maluri
Kuala Lumpur

Lay-Out

– *AC Designers Sdn Bhd*

COVER: Spiral ramps on Metropolitan Expressway, Japan.

The theme for this issue of the REAAA Journal is
ROAD SAFETY.

It is thought appropriate therefore to publish
the keynote address delivered by Dr. Ian Johnston,
Chairman of the REAAA Technical Committee
at the recent Conference on Asian Road Safety, 1993
held in Kuala Lumpur, Malaysia
in which the REAAA played
a major role in its organisation.

In addition, the summary reports of
the four Workshop Sessions and the Charter
are also published for the benefit of
REAAA members who have interest in the subject.

KEYNOTE ADDRESS
CONFERENCE ON ASIAN ROAD SAFETY (CARS '93)
25-28 OCTOBER 1993, KUALA LUMPUR

HOW USEFUL TO ASIA IS THE ROAD SAFETY EXPERIENCE OF MOTORISED COUNTRIES?

by

DR. IAN JOHNSTON
Chairman, Technical Committee
Road Engineering Association of Asia and Australasia

I am deeply honoured to have been invited to present the keynote address to this conference on Asian road safety. I know just how concerned the governments of the region are with the safety problems being faced during this period of rapid economic and industrial growth. It is an unfortunate fact that, everywhere in the world, the introduction and rapid growth of personalised, motorised transport has brought with it an appalling increase in human loss and suffering.

At the same time as being honoured by the invitation, I feel poorly equipped for the task. While I have spent a large part of my career as a professional in the road safety field, it has been in Australia. I am not an expert on road safety in Asia. Indeed, it is only in the last three to four years, through my links with the Road Engineering Association of Asia and Australasia, that I have had the opportunity to travel in the region and to discuss its safety problems with professional colleagues.

I have not come here with any answers. What I would like to do this morning is tell you something about some of the lessons we have learned in trying to deal with the safety problem, in the hope that some of them may be useful to you and that you might be able to make progress a little faster than we were.

I would like to begin by discussing the different ways of measuring safety and their likely usefulness to you. Let me also warn you right now that I believe these macro-measures of safety have very limited value and that I am strongly opposed to comparisons of one country's safety performance with that of another.

Fully motorised countries usually measure and compare safety in terms of the number of casualties per vehicle or per kilometre driven. The question they ask is: how safely does our road transport system operate? We mostly use registered vehicles as the base since good measures of distance driven are rarely available. In Australia the number of deaths per 10,000 registered vehicles is now less than 2. If we use the standard method followed by the International Road Federation in its publication "World Road Statistics", the comparable figure for Malaysia is around 16 and we might conclude that safety in Malaysia is nearly ten times worse than in Australia. But this method excludes two wheeled vehicles from its computation of registered vehicles.

In Australia, this makes little difference as motorcycles account for only about 3 per cent of all vehicles on the roads, but in Malaysia, where motorcycles are closer to 60 per cent, their exclusion makes the internationally published death rate per registered vehicle a nonsense figure. When we include motorcycles among the registered vehicles the level of safety in Malaysia suddenly improves from around 16 to around 7 deaths per 10,000 registered vehicles. So it seems Malaysia is not ten times less safe but about four times less safe than, say Australia. But I maintain that even this figure is not really valid because we are comparing two very different personal transport systems.

The second macro measure of safety is the number of deaths per 100,000 population. This measure addresses the question of an individual's risk of dying from a traffic accident. Its use has one great advantage over the first measure and that is that it enables direct comparisons between traffic crashes and other causes of death within a country. In this way, governments can examine all the public health problems confronting them and make decisions on how best to allocate scarce resources. In Australia, traffic crashes are the major cause of death for persons under the age of twenty-five and thus road safety can command a major share of resource. In many rapidly industrialising countries there are many other public health problems competing for the resources available.

The number of deaths per 100,000 population is not really any more valid for international comparisons than the number of deaths per 10,000 registered vehicles. This is because the per capita death rate is very closely related to the level of motorisation in a country. For example, Pakistan, which has a very low level of motorisation, has a traffic fatality rate that is only one quarter that of the United States. While there is no doubt that it is statistically true that the risk of a Pakistani dying in a traffic accident is much lower than that of an American the comparison is of no practical value.

And, if comparisons are of no practical value then why do we bother?

In my opinion, international comparisons of safety have only one useful role – and that is to help a country to set realistic safety targets to aim for. It is always valuable to look around and find the best performance that others have been able to achieve. But the selection of countries to compare with is crucial. If the targets are to be realistic and achievable in the medium term then the appropriate questions are: what is the best level of safety achieved by any country with roughly our level of motorisation? What is the best level of safety achieved by any country with the same kind of personal transport system as we have? In saying this, I am assuming that it is far more realistic to improve safety within the prevailing social, economic and transport development climate that exists in a given country than to radically change that environment in the short term. Does any country represented here today really believe that it will radically change its personal transport system in the next five or so years? Because that is the time frame over which your safety actions of now will have most effect.

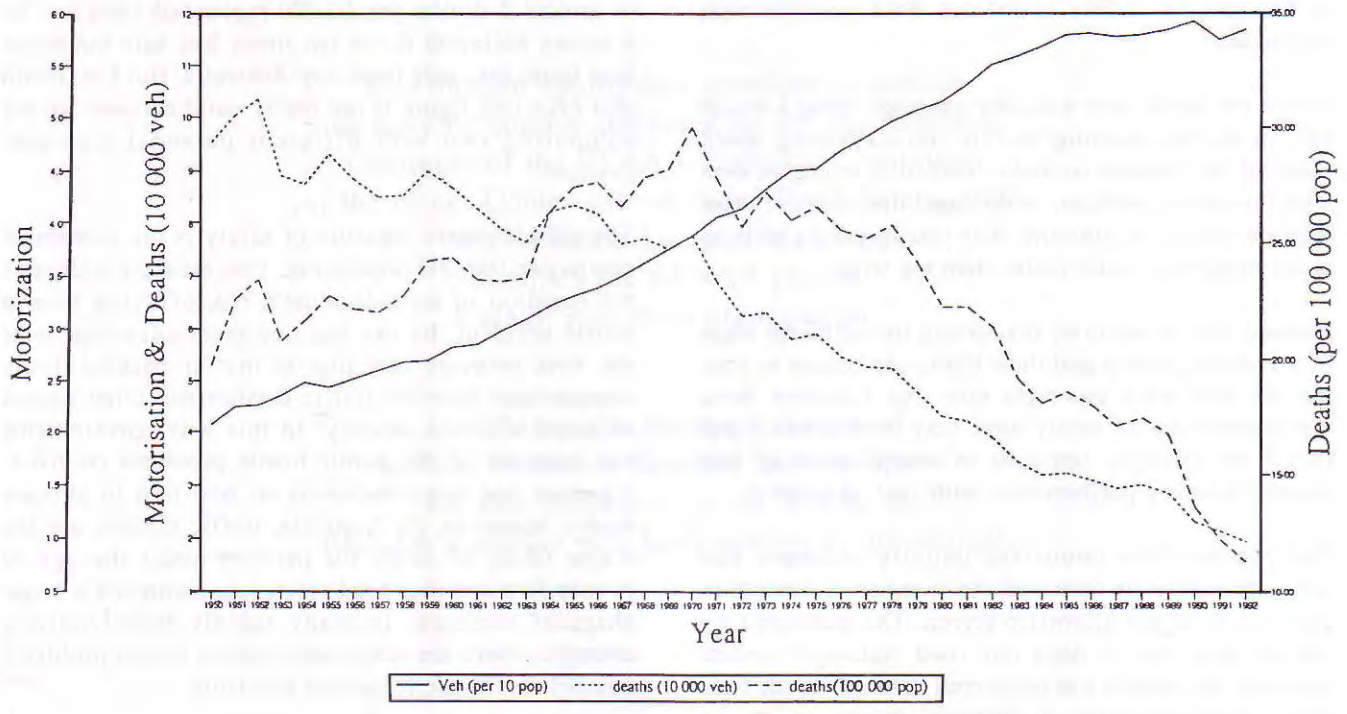
It is, therefore, quite inappropriate to compare Malaysia with Australia in order to set targets for safety in Malaysia. But nor is it sufficient to make simple comparisons within the region. It is more valid to compare safety progress in Indonesia and Malaysia, where the frequency of two wheeled vehicles is roughly comparable and where land use patterns are reasonably similar, than it is to compare Indonesia with Singapore. In Indonesia, motorcycles account for almost seventy per cent of registered vehicles while in Singapore they account for less than twenty-five per cent.

I will return to this issue of target setting later.

Having looked at the two main macro-measures of safety and having questioned the value of international comparisons I would now like to consider the historical patterns of safety progress in motorised countries and to challenge the assumption that this history will necessarily be repeated in the Asian region.

This graph (Figure 1) summarises Australia's road safety record over the last forty years or so. The level

Figure 1: AUSTRALIA 1950–1992
Summary Accident Statistics



of motorisation is in terms of the number of registered motor vehicles per ten of population. Australia is one of the most heavily motorised nations in the world, at around six vehicles for every ten persons. The death rate is deaths per 10,000 registered vehicles. Note that, despite continual growth in vehicles, Australia's death rate per registered vehicle, has fallen. In other words, the level of safety per unit of road use has steadily improved as road use has increased. It is little wonder, therefore, that this measure of safety is the most popular measure amongst politicians and road safety administrators in motorised countries. It makes all actions look good. This continual improvement is the result of many things: the construction of more and better roads as traffic volumes increased, the development of more effective traffic management systems, continuous improvement in vehicles, both their design standards and their in-service condition, improvements in traffic regulation and, of very considerable importance, a general maturing of the road user population.

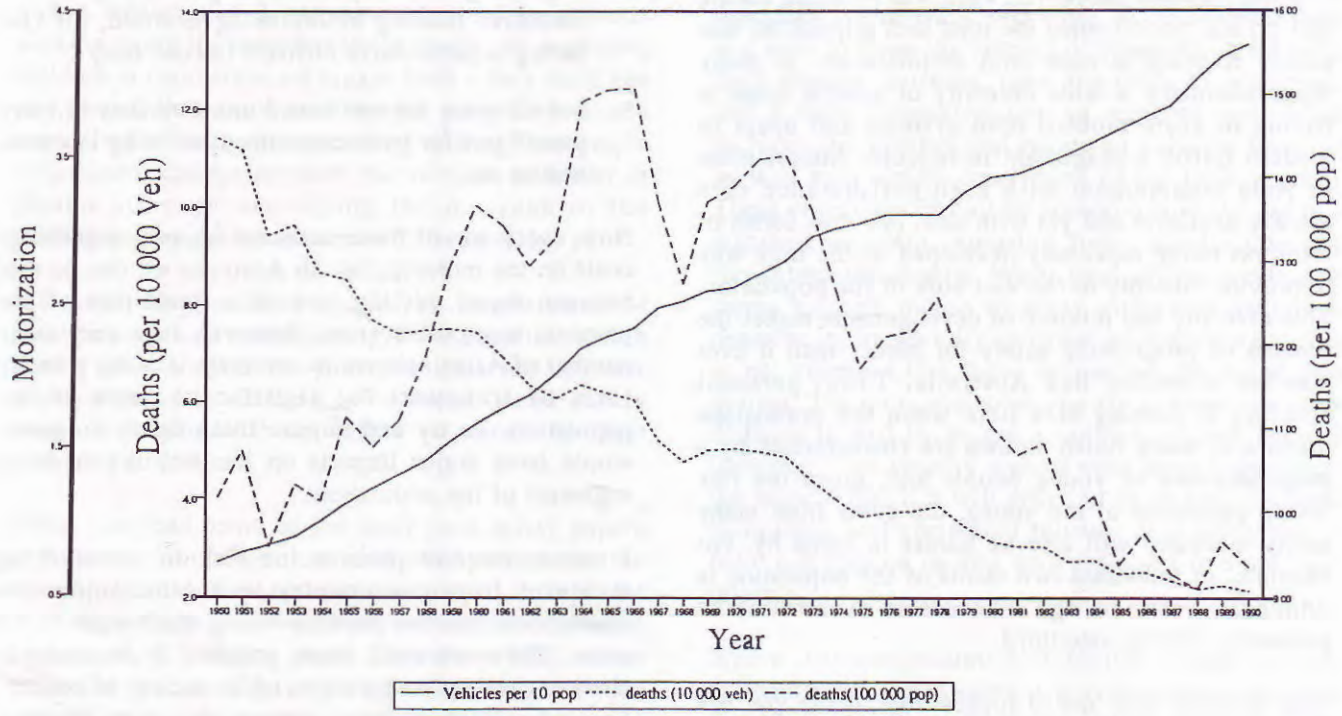
The last point can not be over emphasised. As a country motorises, particularly from an initially low level, there is a period of apparent behavioural chaos as the people slowly comes to terms with the impacts of personal mobility. Several Asian nations are still in this stage of transition and I have heard many of my colleagues in REAAA lament the poor behaviour of their fellow countrymen as road users. It is, in my opinion, not misbehaviour so much as inappropriate behaviour borne from inexperience. A generation of patience is required! One lesson we learned very early was the danger of oversimplifying. Crashes are not a homogeneous problem created by bad behaviour, though behaviour is a key element.

Now consider the number of deaths per 100,000 population. Note that as motorisation grew so did the number of deaths per head of population. As road use increased, so the risk of an individual dying increased, and this occurred for almost twenty years before, at a quite high level of motorisation, this measure of safety also began to improve.

Why? I think there are two answers. The first I have already talked about – it takes time for the transport infrastructure to mature and it takes time for people to adapt. But, secondly, the turning point is also related to the fact that eventually the problem gets to a point where governments begin to invest, heavily – both financially and administratively – in improving safety. It was only around 1970 that Australian governments really began systematic road safety programs.

Let me assure you that Australia's experience is in no way exceptional. This next graph (Figure 2) shows the history of road safety progress in the United Kingdom in the same forty year period. Exactly the same pattern is evident. Right through the period the number of deaths per 10,000 registered vehicles fell as motorisation increased, but for the early period of growth in motorisation the number of deaths per head of population got steadily worse. I have shown only

Figure 2: UK 1950–1990
Summary Accident Statistics



two countries, but if I was to plot these figures for almost any western motorised country the pattern would be almost identical.

So where are the various Asian nations now on each of these three lines? Unfortunately, it is difficult to get this data consistently over time for any of the countries in the Asian region. Malaysia, for example, changed its definition of a traffic death from death at the scene to the World Health Organisation definition of death within 30 days of the crash. The figures for Thailand show deaths halving one year, doubling the next, then halving again. Similarly, there is enormous variability in the reported number of deaths over time in Indonesia which leads me to suspect major changes in reporting levels.

But even if we had the data I question whether it would help us to predict what might happen in Asia. I seriously doubt that this almost universal western pattern of safety progress will necessarily be repeated in the Asian region.

There are many factors which may lead to substantial variations in either the longer term patterns or in the time frames taken to achieve the levels of safety now enjoyed by the highly motorised countries. First, countries like Australia and the USA went straight from the horse and buggy to the car; there was never a widespread use of the motorcycle, or motorcycle derivatives such as the bajaj in Indonesia, as a fundamental part of personal transport. For example, in Australia, the peak of motorcycle usage was in the 1920s and 1930s, and even then it did not exceed 15 per cent of the registered vehicles. Secondly, in the western motorised countries the road system, the traffic management system and the vehicles all evolved together. Moreover, each was evolving during that critical period when the road user population was slowly learning to cope with motorisation. In many Asian countries, a wide diversity of vehicle types is having to share modern road systems and adapt to modern traffic management techniques. Motorisation in Asia commenced with high performance cars already available and yet with new, low cost forms of transport being especially developed as the only way to provide mobility to the vast bulk of the population. This diversity and mixture of developments makes the process of progressing safety far harder than it ever was for countries like Australia. Third, personal mobility is coming at a time when the population profiles of many Asian nations are characterised by a preponderance of young people and, given the risk taking behaviour of the young, the gains from many safety measures will also be harder to come by. For example, in Indonesia two thirds of the population is under 25 years of age whereas in Australia the proportion is only one third.

This analysis leads me to suggest that, while you can transfer some safety measures from the motorised nations your problems are of a sufficiently unique character to require the development of your own solutions. To do this, you must have the right kind of data with which to identify, in detail, the nature of your problems, and to monitor your progress in dealing with them.

Some of the most successful measures in motorised nations will have far less immediate effect in Asian nations. In Australia, for example, where almost 70 per cent of all persons killed and injured in traffic accidents are either drivers or passengers in cars, the legislation requiring people to wear seat belts has had a dramatic and lasting effect. In the United Kingdom this same measure has been nowhere near as successful, which might seem strange, until you realise that in the United Kingdom only about 40 per cent of the persons killed or seriously injured are occupants of cars. In India, where only 5 per cent of the persons killed and seriously injured are in cars, seat belt wearing would not have much impact on the overall road toll. This example underlines how vital it is that each country understand in detail the nature of the safety problems facing it.

I also urge great caution in transferring safety measures from one country to another, even when apparently dealing with the same problem. In Australia, even though the proportion of traffic casualties that are motorcyclists is low, we have had considerable success in reducing motorcyclist casualties. The measures taken have included such things as:

* requiring all motorcycle riders and their passengers to wear approved helmets
* requiring motorcyclists to go through quite extensive training before being licensed, (or else facing a particularly difficult licence test)
* not allowing inexperienced motorcyclists to carry passengers for twelve months after being licensed, and so on.

Now, every one of these measures imposes significant costs on the motorcyclist. In Australia we can do that because motor cycling is such a small part of our personal transport system. However, in a very large number of Asian nations the motorcycle is the primary form of transport for significant parts of the population. To try and impose these safety measures would have major impacts on the mobility of large segments of the population.

I cannot over-emphasise the risk in transferring measures from one country to another under the assumption that the problem being dealt with is the same. The motorcycle crash problem in Australia is characterised by young males under the age of twenty-five riding high powered motorcycles. One effective

measure was to prohibit motorcyclists from riding machines with engine capacities over 250 cc in the first two years after being licensed. This, added to the examples I have already given, shows that Australia's motorcycle crash problem and the effective solutions to it, are vastly different from those required in the Asian region.

I would extend this argument and suggest that it could prove just as difficult to transfer safety measures from one Asian nation to another. For example, one of the measures Singapore uses to deal with its pedestrian casualty problem is to impose substantial fines on pedestrians who cross within 50 metres of a designated crossing. This measure could not be applied in Dhaka in Bangladesh.

It is worth spending a moment looking at the pedestrian safety problem in Dhaka because it illustrates the enormous value of having data to describe the particular dimensions of one's own problems. In Dhaka, pedestrian casualties are 60 per cent of total casualties! Dhaka is so crowded, and road space is at such a premium, that one in five of these pedestrian casualties occurs to people described as working or playing on the road surface. I recall, at the REAAA conference in Singapore last year, seeing the results of the installation of overpasses in Dhaka. In an area where most of the footpaths were taken up with street traders, one of the main effects of the installation of a pedestrian overpass was an extension of the room available for the traders and little change in pedestrians crossing at street level. It is easy, in situations such as this, to throw one's hands up and say nothing can be done. However, there are vital clues in the figures coming out of the research. Fully 26 per cent of the pedestrian casualties occurred to persons walking along the road with their backs to the traffic while only 3 per cent occurred to persons walking along the road facing the traffic. In Australia, children in rural areas are taught from a very early age that, where they must walk on the road, they should always walk facing the oncoming traffic. This simple behavioural change measure has obvious potential in Dhaka although conveying the message to the pedestrian population may be a difficult task.

I cannot emphasise enough the importance of establishing and maintaining data systems which enable you to diagnose your problems and monitor your success in dealing with them. Road safety progress begins with an ability to select the right problems to address.

When you read some of the early road safety papers in Australia you realise just what an important role the development of data systems has played. It was not until almost 1960 that we identified the role of alcohol in crashes. I found a paper from the 1950s which estimated that drink driving caused less than three per cent of crashes in Australia. This estimate was based on information available in the police reports of the day. It was wrong by a factor of more than 15! When we began regularly to test for alcohol during post-mortem we found that fifty per cent of drivers who died in traffic crashes had been drinking. Once we had this knowledge, we were able to develop a series of measures to combat the problem and have succeeded to the point where the number of drivers killed with illegal blood alcohol levels has dropped from one in two to less than one in five. The point of this example is not that we have found effective ways to deal with drink driving but that without the right kind of data systems we would not have identified this as one of our special problems.

It is not essential that the data system be elaborate or costly. I would recommend against the immediate adoption of most of the systems currently in use in motorised countries. The costs of data collection at this level of detail are simply too high. As you make progress so you can gradually refine your data systems. I am a great admirer of the simple system developed by the overseas unit of the Transport Research Laboratory in the United Kingdom, specifically for application in motorising countries. I am aware of its trialling in many parts of the region, most recently, I believe, in the town of Bandung in Indonesia. This type of system, properly applied, can underpin a major push for improvements in safety. I am pleased to see that a whole session at this conference is being devoted to data collection and its analysis and to the equally important topic of evaluation.

Without wishing to pre-empt that session I would like briefly to list the key criteria for a useful data system. The objective must be to establish a system by which the number and basic nature of the problem can be described consistently over time. At its simplest level you need to know the number of crashes and, for each, their severity outcome, time and place of occurrence and a basic characterisation of accident type which includes the number and nature of vehicles involved as well as a simple description of the type of crash. These objectives can all be achieved with the use of a standard accident reporting form, ideally common throughout the country. While there are quite elaborate rating systems in use in many motorised nations to describe injury severity or extent of vehicle damage it is not essential that these be part of the initial data system. The more variables you try to cover the more difficult it will be to get a uniform system adopted throughout the country and, of even more importance, the more difficult it will prove to be to have the form completed, and completed reliably. It is preferable to have a minimum of key data collected routinely and reliably.

Where it is not possible to establish simple, uniform national reporting systems it is crucial that a range of specific research studies be carried out to identify and

diagnose the major safety problems. The example I gave earlier of the study of pedestrian casualties in Dhaka in Bangladesh underlines just how valuable relatively inexpensive research can be to supplement and overcome deficient mass data systems. It is only through local data and local analysis that each nation can determine its own problems and hence the appropriate actions to take. No data can be transferred from other countries for this purpose and it is unlikely that the safety diagnosis made in one country will hold in another.

Once you have a reasonable data system and a good understanding of the types of problems faced you can set about selecting a mix of measures to apply. Here, you need to be very wary of the "expert" from a motorised country who can tell you what worked in his country. Only you can judge the probability of it working in your country and only you can judge whether the costs will be acceptable within your social, cultural and development context. For example, the state of Victoria, in Australia, now has compulsory helmet wearing for bicyclists and this has had a significant impact in reducing injuries to cyclists. But it is important to understand that some of the success of the Victorian legislation has come from the fact that it has lead to a decrease in bicycling, especially among teenagers; that is, part of the solution to the safety problem was to discourage cycling. I am not suggesting that this is what the government set out to do, just that it was one of the consequences. It is difficult to imagine the introduction of a bicycle safety measure in, say China, which decreases the role of the bicycle as a form of transport!

I would like to spend a little time exploring this issue of the conflicts that often occur between safety objectives, mobility objectives and wider social and economic development objectives. Most Asian nations share in common population pyramids which are heavily weighted at the younger age groups. As other public health problems are steadily overcome the demands for access to personal transportation among these large numbers of young people will become more intense. In addition, many Asian cities are growing at a pace which is almost impossible for the growth in transport infrastructure to match. The result is an under-developed public transport system and a critical dependence on low cost forms of personal transport. Walking, cycling and motorcycling are the highest risk forms of transport, particularly when they have to co-exist with large numbers of cars and trucks. In motorised countries like Australia and the United States it is important to understand that the nett effect of past transport policies has been to discourage walking, bicycling and motorcycling. There is no doubt that the consequent homogeneity of the vehicle population is good for safety but there is equally no doubt that policies which discourage the cheaper but higher risk forms of personal transport will remain unacceptable for a long time in most Asian countries. What must, therefore, be addressed is how to maximise safety within the existing context.

I hope that, so far, I have not given the impression that the safety measures developed in the western motorised countries are irrelevant to the Asian nations. There is much that can be, indeed is being, transferred. There are many aspects of road design, construction and maintenance; traffic management tools and techniques; legislation and regulation; vehicle design and programmes directed at behaviour change that, with appropriate adaptation to suit local cultural contexts, can be applied. But it is equally true that some of the major safety problems characteristic of Asian nations have never been experienced in the western motorised world and these will require innovative solutions. Improving the safety record of the low cost two and three wheeled forms of transport so characteristic of many Asian cities is, without doubt in my opinion, one of the greatest challenges to be faced. There is no measure on the shelf in the motorised countries which can be adopted to cope with this, the largest problem you face. There is a clear need for some sharply focussed research studies to diagnose the problems a little more clearly and to suggest possible countermeasures. I must say I was delighted to see in the programme a session tomorrow on just these issues. There is also a very strong case for an intra-regional working group of professionals to share the experiences of the individual countries in the region. Such a regionally based expert group could do much towards the solution of the important set of uniquely Asian safety problems.

What is more important from the experience of the motorised countries is the strategies that have been adopted to tackle problems, rather than the individual measures themselves. This is not the place to discuss the strategies in detail, and there are several good books which provide overviews.

By looking at these strategies, you can begin to ask:–

Is it possible to imagine special lanes for bicyclists, or even motorcyclists in Bangkok or Jakarta? Are there simple design changes to the bajaj that will help protect the occupants? And so on. Use your imagination to develop your own specific measures based on strategies that have been shown to be effective elsewhere.

At this point, I would like to return to the issue of selecting safety targets. At the outset, I suggested that the most appropriate macro measure in the Asian context is the number of deaths and serious casualties per head of population. This enables road safety to be considered in the context of other public health problems facing individual countries. I also suggested that targets for progress should be set in the context of the best performances achieved by countries at similar stages of motorisation and with similar types of personal transport systems.

For significant safety progress to be made, however, a quite different set of targets is also required. These targets relate to the specific safety problems each country faces. Thus Bangladesh might set targets related to reducing its pedestrian casualty problem. Moreover, the targets, to be truly useful, should be as specific as possible. For example, in Dhaka, a safety target might be to halve the number of pedestrian casualties which occur to pedestrians walking on the roadway with the traffic at their back. In Indonesia, for example, there may be a target relating to the reduction of casualties to occupants of the bajaj. And so on. These problem-specific targets are far more valuable than those expressed as reductions in the number of casualties per head of population or per 10,000 registered vehicles. It not only focuses action on the appropriate problems but has the potential to bring responsibility and accountability to the institutions charged with putting the safety measures in effect.

This brings me to the last major issue I wish to discuss, that of institutional co-operation and accountability. If you were to ask me; what is the single most important lesson that the western motorised nations have learned about how to improve road safety then, without doubt, my answer is that the key to improvements is to get all the institutions working together and to make them genuinely accountable for achieving their safety targets.

I said earlier that just about every western motorised nation has been through a very similar history of progress in road safety. Certainly, the time scales have been different and the rates of improvement in the macro measures have been different but the patterns have been essentially the same and a very large number of countries now have very similar levels of safety. This is very interesting when you consider that the mix of safety measures put in place has been very different. The United States and Australia have almost identical levels of safety per unit of road use but they have been achieved with vastly different packages of safety measures. In the United States, the emphasis has been on the gains achievable through road design, vehicle design and traffic management whereas in Australia the emphasis has been much more on behaviour control through legislation and regulation. What this teaches us is that there is no single, correct solution to any given problem. There is always a range of partial solutions and the question of how well they work is related to the effectiveness of their implementation. In other words, what matters most is not so much what you do but how well you do it. This is true, of course, only if the measures selected are appropriate to the problem.

The trick is how to get institutions to work together. Road safety is one of those areas of government responsibility which does not rest with any one authority. The road builders have an obvious impact. So do the police and the justice system. But so do the urban planners, the health system administrators, the educators, the transport policy people, and many, many others. In such a complex administrative system it is very easy for each department to blame every other department for a low level of safety. The road builders can say to the police "it doesn't matter how good a road system we build if you won't enforce lane discipline and control speed". In turn, the police can say "no matter what we do, the dreadful state of the roads makes our work ineffective". And so on. In my career in Australia I heard these sorts of things said over and again.

I have long admired the Japanese model for dealing with this problem. When Japan began to motorise rapidly and its road toll initially climbed, a special road safety unit was set up within the Prime Minister's department. All the key departments were represented and each was set specific targets to achieve. I believe it is critical that a high level group, representing all the institutions which must take action, is formed to set targets, to establish priorities, to monitor progress and, above all, to accept responsibility for lack of progress.

You might think we learned this long ago, but we didn't. In Australia, it is only in the last five years or so that different government institutions have begun to meaningfully co-operate in a truly integrated attack on the road toll. The latest road safety strategy in Victoria was jointly prepared by the Road and Traffic authority, the Police and the government body which provides financial compensation for transport accident victims. The drop in the road toll recently has been remarkable and is directly related to both this institutional co-operation and to the level of resources applied. There have been no truly new measures but the level of effectiveness of many of the already existing safety measures, particularly those relating to traffic law enforcement, has increased dramatically.

Let me give just one example of what I mean. I mentioned earlier that one of Australia's greatest safety problems is the role of alcohol in crash causation. The most effective measure we have is what we call random breath testing, whereby the police stop motorists at random and take breath samples, charging those who are found to be above the legal limit for alcohol. However, we learned from our evaluation research that, to be successful, this measure requires a very high level of enforcement. Unless there is a high probability of being caught when you are driving above the legal limit of alcohol the behaviour will continue to occur with great frequency. The police were struggling to get the enforcement to the required high level and to keep it there. For a start, they did not have sufficient funds to purchase the requisite equipment. Secondly, there were many other pressures on the police for other kinds of law enforcement and random breath testing is not especially popular among

the police themselves. Two things happened to integrate all the measures and to get the enforcement level to the required heights. The government insurance agency which is responsible for compensation to road crash victims provided the funds to the police to purchase the necessary equipment. Equally importantly, they invested enormous sums of money in mass media public education campaigns with the objective of making drink driving socially unacceptable behaviour. This, in turn, created public pressure on the police to maintain random breath testing at a very high level. Thus public education and enforcement were properly integrated and funds actually flowed across institutional boundaries. And, of course, the insurance agency saved far more in reduced payouts than it spent.

It is interesting that many western motorised nations are now experiencing a new period of quite substantial reductions in the number of road casualties. Admittedly, part of the explanation lies in the general economic recession being experienced because this has reduced the amount of travel. Nonetheless, it seems equally clear that the gains are in part the result of the more effective implementation of measures which have been known and available for some time but for which the potential has not been fully realised. The gains are being made as a result of the integration of a range of measures directed at each major problem, particularly as a result of shared responsibility across all the relevant institutions and with accountability for success being clearly assigned to the relevant institutions. It has taken the motorised nations something approximating three decades of experience with road safety to learn this lesson. It ought to be within the reach of the nations of Asia to learn this lesson far more quickly and, as a result to make progress at a faster rate.

It is my sincere wish that this happens and that this Conference proves to be a building block from which great regional co-operation will spring. You can draw from our experience but mostly in terms of how to establish data systems and what kinds of strategies work. The specific measures you must develop mostly for yourselves as you increase your understanding of your own special problems.

I wish you every success.

CALL FOR PAPERS!

Papers are solicited for the coming issues of the Journal.

The theme for the July issue is

"Low cost road construction and maintenance"

Please contact the Secretariat or Associate Editors in your country.

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SAFETY, MOBILITY ENVIRONMENT AND LANDUSE

The Workshop Session was centred on the paper entitled "Safety, Mobility Environment and Landuse" by Prof. Knoflacher Herman from the Technical University of Vienna, Austria. His paper dealt with the relationship of safety with the mobility environment which is the infrastructure provided for different modes of travel. Landuse emerges as the key element for focussing safety countermeasures.

Issues specific to Asian countries that were raised during the course of deliberations included:–

a) high growth rate of motorized two wheelers in Asian countries

b) difficulties in changing modal share from private motorised modes to public transport systems and non-motorised modes of transport

c) concern regarding the degree of success in achieving alternate landuse plans

d) financing of transport infrastructure

The final recommendations emerging from the discussion is summarised in the matrix below:–

Strategic Planning Measures require policy decisions at the highest level. Innovative solutions are required to address country-specific issues regarding choice of mode (kind of public transport, non-motorised transport) and appropriate infrastructure which will reduce the overall system speed and promote a sustainable transport system.

Management Measures can be adopted in the short term to promote safety, based on the relationship between human behaviour and the man-made environment. The measures include:–

a) fiscal disincentives to discourage the use of private motorised modes of transport

b) re-allocating priorities to various modes of transport (non-motorised and public transport)

c) designing infrastructure to promote the optimal speeds in the context of landuse and mix of traffic

In a nutshell, Asian countries need to evolve traffic safety countermeasures which are based on the relationship between mobility environment and landuse, leading to sustainable transport systems in the long term.

	LANDUSE RELATED	SPEED REDUCTION RELATED
Strategic Planning Measures.	• Mixed landuse planning • Landuse planning to encourage optimum mode choice.	• Integrated transport system
Management Measures.	• Parking layouts • Parking fees	• Traffic calming measures

SUMMARY REPORT OF WORKSHOP SESSION 2

ROAD ACCIDENT COUNTERMEASURES

Two papers were presented, one by Dr. Halimathun Mohd Khalid of Malaysia which examined the problem of road user behaviour in Malaysia and another by Mr. Bhatnagar on a proposed accident investigation unit in India. Dr. Halimathun described some interesting personality and attitude differences found between motorcyclist and drivers and she raised a number of implications for engineering, education and enforcement countermeasures.

Mr. Bhatnagar demonstrated the serious shortage of accident information in the Punjab State of India using the example of a major bus accident and he outlined the main features of a proposed permanent accident investigation unit. The objective of this unit was to carry out legal enquiries of major accidents with a view to identifying the contributory factors and making recommendations for better driver training, enforcement and engineering.

Some of the issues raised during the lively discussion were:–

a) The difference between accident investigation units, legal enquiries and in-depth research studies. It was agreed that these functions needed to be separated and that in-depth research studies should be focused on identified, major accident/ casualty groups

b) The preference for "passive" versus "active" measures. In general it was felt that there should be a balance between the two although the effectiveness of "passive" and "self-enforcing" measures should be recognised

c) The difficulty in changing attitudes and behaviour. Inspite of the difficulty it was felt that instilling safety attitudes is an important long term goal

d) The balance between rewarding and punishing road users. The need to encourage and reward road users was stressed

e) The conflicts between the need for road user segregation and shared road space. Although shared road space can act as a safety measure the consensus was that, in the long term, road users should be segregated where appropriate, and road designers and planners should aim for clearly identified road hierarchies/

f) The balance between sensitising the public and decision makers to road safety and not over saturating them was stressed

A large number of recommendations were put forward and are as summarised below. No attempt is made to prioritise them as priorities for action will vary considerably for different countries.

I. STRATEGIC RECOMMENDATIONS

INSTITUTIONS AND COORDINATION

1. *Safety Plans*
   - Publish a clear action plan with budgets
   - Establish clear accountability
   - Set realistic targets
2. *Institutions*
   - Establish a high-powered central agency for coordinating, planning and monitoring road safety action
   - Establish a permanent secretariat for the road safety agency
3. *Funding of Projects*
   - Decision makers need to be made aware that project funding for road safety components is encouraged (without cost-benefit constraints) by the World Bank and other lending/aid agencies
4. *Research*
   - Research is essential and the setting up of central/regional institutions should be considered
   - Countermeasures need to be evaluated and feedback made continuously into action programmes
5. *Costing of accidents*
   - Countries should adopt costing methodologies and publish accident cost figures

II. COUNTERMEASURE RECOMMENDATIONS

A. GENERAL REQUIREMENTS

1. *Accident investigation*
   - Establish data recording and analysis systems

- Establish accident investigation and prevention units
- Make use of conflict data and other intermediate measures for diagnosis and evaluation

2. *Research needs*
   - Produce comprehensive explanatory and predictive models of behaviour and accidents
   - Carry out evaluation and monitoring studies
   - Carry out focused, in-depth studies to clarify the contributory factors for major/casualty groups. It should be noted that considerable resources are needed for this technique and its use is only recommended where there is an essential need for information which is otherwise unavailable

3. *Approach/Framework*
   - Countermeasure approaches should be:
   - Multidisciplinary
   - Integrated
   - Systematic and logical
   - Low cost and effective
   - Compatible with community goals and social, physical and environmental factors

B. SPECIFIC COUNTERMEASURE REQUIREMENTS

1. *Education and publicity*

   Programmes and campaigns should be:–
   - Based on scientific data
   - Focused on target groups, i.e. the vulnerable road users and also on decision makers
   - Integrated with enforcement
   - Backed up with training on methods of design and implementation
   - Compatible with social marketing approaches, i.e. road users treated as customers

2. *Enforcement*

   Enforcement should:–
   - Reward as well as punish road users
   - Avoid alienating the public
   - Be sustained until objectives are achieved
   - Adopt strategies based on objective data
   - Sufficiently intensive to encourage a high perceived risk of apprehension

3. *Engineering*

   The engineering sector should:–
   - Consider the local road and traffic operating environment when adopting road design and standards
   - Avoid unsafe designs, i.e. learn from the experience of other countries and use road safety audits
   - Adopt appropriate engineering approaches to reduce hazardous locations in the road network
   - Adopt mass action approaches to reduce random urban accidents
   - Introduce and rationalise speed limits, ensure speed limits are consistent and consider zoning
   - Adopt traffic calming approaches where appropriate
   - Encourage the use of road design features to affect and influence road users expectancies
   - Segregate major groups of road users where appropriate and establish road hierarchy systems

SUMMARY REPORT OF WORKSHOP SESSION 3

ORGANISATIONAL ASPECTS AND POLICY

The objective of the Workshop Session was to identify ways of improving road safety organisation and policy in Asian countries and to make recommendations with priorities for action. The prepared paper by Mr. Richard Muskag of Norway defined organisational aspects of road safety as the *"attribution of responsibilities between the different public bodies involved in road safety work and the procedures for cooperation between the bodies involved"*.

It was accepted that the main organisational question is how to coordinate the work which is carried out so that total efficiency is improved. The organisation will be different in different countries because of the split of responsibilities between ministries, e.g. the size of the country and other factors. The paper identified two organisational models for discussion:–

> Model A where every ministry and body involved in road safety work remains entirely responsible for its own activities which includes everything from policy making to execution;
>
> Model B where all road safety work is centralised in one body responsible for all policy making and planning but which hires the services of the executive bodies such as the Ministry of Public Works and the Police;

and then proposed a solution which combines the best of both models. This consists of a National Road Safety Board/Council composed of all relevant public bodies such as:–

- Ministry of Transport
- Ministry of Public Works
- Ministry of Justice
- Ministry of Health
- Ministry of Education
- The Police

Other non-government organisations such as insurance companies could be included. The National Road Safety Board/Council is responsible for policy planning of road safety. The individual Ministries or public bodies remain responsible for execution. There would also be a National Road Safety Office which would act as a permanent secretariat for the Board/ Council and have tasks of:–

- Planning
- Accident analysis
- Information and education

It was generally agreed by the Workshop participants that the proposed model was sound. There are however problems of implementation.

It was emphasised that it takes considerable time and much effort to convince politicians and other policy makers that road safety should be given sufficient attention. There are benefits in having high level politicians on the National Road Safety Board/Council but in some countries, these people have too many other commitments and as a result, the Board/Council does not meet frequently enough (once only in 9 years in one case). Enthusiasm for the role can also change with the person. It is essential however to have high level commitment from all the bodies involved.

Malaysia was considered to be a good example of national coordination. The Road Safety Council meets three times a year. The Chairman is the Prime Minister and the Minister of Transport chairs a Working Group. The Council includes representatives from the private sector who have an essential role in implementing road safety educational programs.

It was expressed very strongly that the responsibility and accountability of the Road Safety Board/Council should be institutionalised and defined in law.

Organisational aspects should also involve local levels of government and any other structures that are in place including religion. It was agreed that providing education and information on road safety to community groups was an important function of the National Road Safety Office. All opportunities should be taken, for example when there has been a bad accident. Community involvement will tend to relate to local issues but this can be made complementary to national issues.

An assured source of funding for administration of the Road Safety Office was identified as being essential. Most of this cost should ideally be funded from a levy, e.g. on fuel, tyres or vehicle insurance and paid directly to the National Road Safety Office. Another possible source of revenue for the office is from sponsorships by private sector firms who gain publicity from being associated with road safety promotions. It is possible

that the World Bank or Asian Development Bank's assistance could be obtained to set up a National Road Safety Organisation as part of a larger project.

Specific funding for road safety work should also be earmarked within the various Ministries' budget together with accountabilities for achievement of output or targets. The National Road Safety Office should develop a national road safety strategy including targets.

This should cover:–

- organisational aspects
- legislation
- improvement of the road infrastructure
- collection, treatment and storage of data
- law enforcement
- vehicle testing
- driver training and examination
- information and education
- rescue of accident victims

This was considered to be one area where foreign experts could assist. The strategy should be broken into a number of themes e.g. safer people, safer vehicles, safer roads. It was essential that the funding implication of policies were worked through and possible funding sources identified. Interest in a road safety measure often depends on who will have to pay. The government will more easily introduce measures that increase vehicle standards or driver training because it is the driver that pays. The car owner will more easily accept measures concerning the road because the government will pay. There is also tendency to want to do glamorous things rather than the most cost effective measure. This conflict needs to be addressed in developing road safety policy. Road safety must always be balanced until transport efficiency and the road safety effect of other transport policies e.g. privatisation of public transport is considered.

In summary then, organisational and policy aspects of road safety should be:–

- be built on existing social structure
- have high level political commitment
- be soundly based technically
- be financially justified
- have assured funding

Priorities for action would be:–

- establish a National Road Safety Board/Council and a secretariat
- Define the responsibility in law
- Prepare a national road safety strategy
- Prepare and disseminate road safety educational material
- Work with community groups to develop local initiatives

INTERNATIONAL COOPERATION – TECHNOLOGY TRANSFER

The agreed definition is that *"technology transfer is the bringing about and the will to accept a change"*. That is, the first consideration should be how to bring about change rather than how to deliver new technology.

For developing countries, transfer is normally by technology already applied and found effective in industrialised countries but with the very necessary adaptations. It should also allow developing countries to progressively find their own solutions.

KEY FACTORS IN THE SUCCESS OF TECHNOLOGY TRANSFER PROJECTS:–

- It should be a continuous process starting from the time that research priorities are identified to the time the newly developed technology is implemented and then monitored
- Harmonious relationship between the providers and users of the technology with continuous face-to-face contact
- Sharing information and experiences with other research groups
- Highly operational small teams working in the field and establishing confidence
- Messages must be reinforced using several media in order to reach the different senses of the user including:–
  - clear definition of the objectives
  - readily understandable benefits of the change
- Important to have counterparts or officials able to promote dissemination within the organisation
- Long term planning is essential

FACTORS THAT HAVE LED TO FAILURE:–

- Lack of inertia of local institutions without involvement or commitment
- Conflict between self-sufficiency and dependence on imported technologies
- Mismatched technologies
- Commercial conditions or bilateral aid imposing a technique without the possibility for adaptation
- Poor cooperation and communication between public and private sectors
- Gap between programmed project duration and actual time needed for effective assimilation by the receiver

OBSERVATIONS OF THE WORKSHOP

a) The use of old technologies or low-cost measures are obviously less attractive to politicians or engineering practitioners than high-cost new technology due to the lack of glamour in managing such projects

b) It should be remembered that the developed countries do not have proven technology for the problems existing in many developing countries as they have never experienced similar mixes of traffic and road user behaviour

c) Training of developing country personnel by Aid Agencies is not always transferred by the trainees within their own countries. They are frequently not in training positions themselves or are often rapidly promoted out of such position

RECOMMENDATIONS OF THE WORKSHOP

a) Strategic, long-term planning is essential (minimum 5 years)

b) Due to the fact that there are now many organisations working towards the improvement of road safety in developing countries (eg. PIARC, OECD, WHO etc.) but that they have limited funds to do so, there is a need to encourage these organisations to work together and coordinate their actions

c) A world centre should be establish as a central contact point for anyone seeking information on any aspect of roads and road safety. Its function would not necessarily be to disseminate knowledge directly but to inform of the best source of such information, advice or assistance

As an update, a small secretariat is now being established in Brussels to launch an Interchange Network to:–

- encourage the spread of effective processes of technology transfer
- collect and disseminate information on who to contact for access to specific technology transfer resources

d) There is a need to set up a network of professionals or experts from around the world and specially designed manuals should be produced

e) On training organised by Aid Agencies, guideline levels of trainees having a responsibility for training in their own country should be specified for each course held to promote the spread of the technology regionally

f) The provision of local budgets for safety improvement should be encouraged with specific local accident reduction targets with the aim of promoting the use of more technology which is highly cost-effective

g) It would seem that the best way in which new appropriate technology can be developed is probably as a demonstration project initially in a single country

h) It is essential that careful monitoring is carried not only of project implementation but also its long-term effectiveness

CHARTER

THE KUALA LUMPUR AGENDA

The Kuala Lumpur Agenda, as the Charter is called has arisen out of the Forum that was held during the Conference to discuss the required future action plans and programmes

Road accidents are a major problem in the Asian Region. The rapidly growing economies and increasing motorisation will inevitably lead to a deteriorating road safety situation. Opportunities exist to intervene and prevent unnecessary deaths and disabilities and the resulting economic losses. The following recommendations derived from the above Conference are intended to provide guidance for countries seeking to tackle their road safety problem.

GUIDING PRINCIPLES AND INITIATIVES

1. Strategic planning for road safety is important and this should be related to transport systems and land use policies.

2. Targetted safety programmes should be identified systematically. Prioritised short and medium-term accident countermeasure programmes need to be developed. This should include proper assessment before implementation, monitoring during implementation and evaluation on completion.

3. The establishment of effective organisational and management structures for the development and implementation of road safety policies and measures at national, regional and local levels is strongly recommended. Coordination of all relevant agencies, including private and voluntary organisations is essential to the success of the programmes. Commitment at the highest political level is crucial to success.

4. Adequate public funding of road safety activities needs to be allocated. In some countries good results have been achieved by earmarked safety funds. Opportunities for supplementary funding through private sponsorship or sources, for example, insurance, should be explored. Funding for road safety is increasingly available from development banks, for example, World Bank and ADB and bilateral agencies. Countries are encouraged to tap into such funds. (Research indicates that economic losses due to road accidents are typically 1-2% of each country's annual GDP).

5. In order to optimise the impact of the limited resources available for road safety improvements, it is essential that an assessment be made of the costs of different types of accidents. Countries should initiate research on costs of road accidents so that road safety countermeasures and action plans can be systematically assessed for cost effectiveness.

6. The development of local road safety specialist and researchers is essential to ensure sustainability of effective road safety programmes. This can be achieved through in-country practical training, study tours and international cooperation.

7. Research is a vital element of effective safety programmes. Countries are encouraged to collaborate and to initiate research programmes on appropriate issues. The establishment of a regional and/or national road safety research institute should be considered.

8. Public awareness of safety issues and requirements should be raised through publicity and propaganda. Education programmes for target groups, for example, children, should be developed and implemented.

9. Effective systems for accident data collection and analysis are essential for development and assessment of countermeasures. Countries with inadequate systems are encouraged to improve them; and those that already have good systems are encourage to collaborate and harmonise to facilitate comparisons, for e.g., by standardising on TRL MAAP system.

10. Safety of vulnerable road users should be accorded the highest priority in the development of countermeasures.

11. Research and cost effective countermeasures should focus on the specific needs of Asian countries and such information should be disseminated through appropriate manuals, guidelines and training courses.

12. Regional cooperation is required in a number of sectors related to road safety. Initially, the focus

should be on compilation and review of current traffic legislation and regulations.

13. The training of safety professionals is essential to ensure effective programme management. Comprehensive courses for trainers in the Asian region should be implemented through REAAA, with financial assistance from ADB. A road safety journal for Asia should be launched.

14. Technology transfer in the road safety field should be enhanced through appropriate regional and international networks, for example, PIARC (Permanent International Association of Road Congress).

SECOND CONFERENCE

A Second Conference on Asian Road Safety to be held in 1995/1996 is proposed.

Its objectives will be:–

i) to follow up the results of the above initiatives

ii) to monitor the changes in the road safety situation in Asian countries

iii) to update safety professionals on the latest developments

THE IDENTIFICATION, PRIORITISING AND ANALYSIS OF ACCIDENT BLACKSPOTS IN MALAYSIA

by

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and

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ABSTRACT

This paper presents the accident investigation and treatment framework developed for the Seremban and Shah Alam Pilot Project. Accident data are based on the revised police accident form POL27(Pin 1/91) specially designed to enable processing and analysis to be carried out using a customised microcomputer accident analysis package, MAAP. A hazardous location identification and prioritising system based on accident maps, link-node-cell and grid coordinates was developed for urban areas while a kilometre post system was proposed for highways in rural areas. In-depth analyses on selected blackspots are discussed and appropriate countermeasures proposed.

1.0 INTRODUCTION

Since 1990 Universiti Pertanian Malaysia (UPM), Ministry of Science, Technology and Environment under the mechanism of IRPA and the National Road Safety Council (MKJR) have been funding research programmes to improve the accident data collection and analysis system in Malaysia. The programmes also aim to encourage wider usage of the system to assist in the identification and effective treatment of accident blackspots to improve road safety in this country. In view of the massive number of accident records to be analysed (96,500 nationwide in 1991), the use of computer based analysis systems was investigated in early 1990 and a micro computer accident analysis package, MAAP, licensed by the Transport Research Laboratory (TRL), United Kingdom, was customised to fulfil the requirement.

A pilot project on the diagnosis system for analyses of road accidents was then carried out under the funding of the research sub-committee MKJR with the cooperation of the Royal Malaysian Police (PDRM) and TRL, United Kingdom. The two districts of Shah Alam and Seremban were selected as pilot areas where the PDRM agreed to cooperate by using a redesigned report form in addition to their current accident form, POL27 (Pin 1987). The new police accident form, POL27 (Pin 90 – Pilot Project), was designed to be easier to complete and incorporated several new items of information of importance to highway engineers; in particular, more accurate location data and collision diagrams. Following appropriate training of relevant police officers in the completion of the new form, it was introduced fully in these two districts from the beginning of 1991.

During the course of this trial period several improvements to the form were recommended, though these were relatively minor in nature. A revised version of the form known as POL27 (Pin 1/91) was then printed in late 1991 for its full-scale implementation in January 1992. An extensive training programme for the police investigation officers over the whole country was carried out prior to 1992.

2.0 METHODOLOGY

2.1 Theoretical Framework

In this phase the framework of accident investigation and treatment was developed. The accident analysis process involves the identification of accident blackspot locations, establishing general patterns of accidents, analysis of the factors involved, site studies, implementation of countermeasures and evaluation of their effectiveness. The overall process is summarised schematically in Figure 1[(1)]. The level of

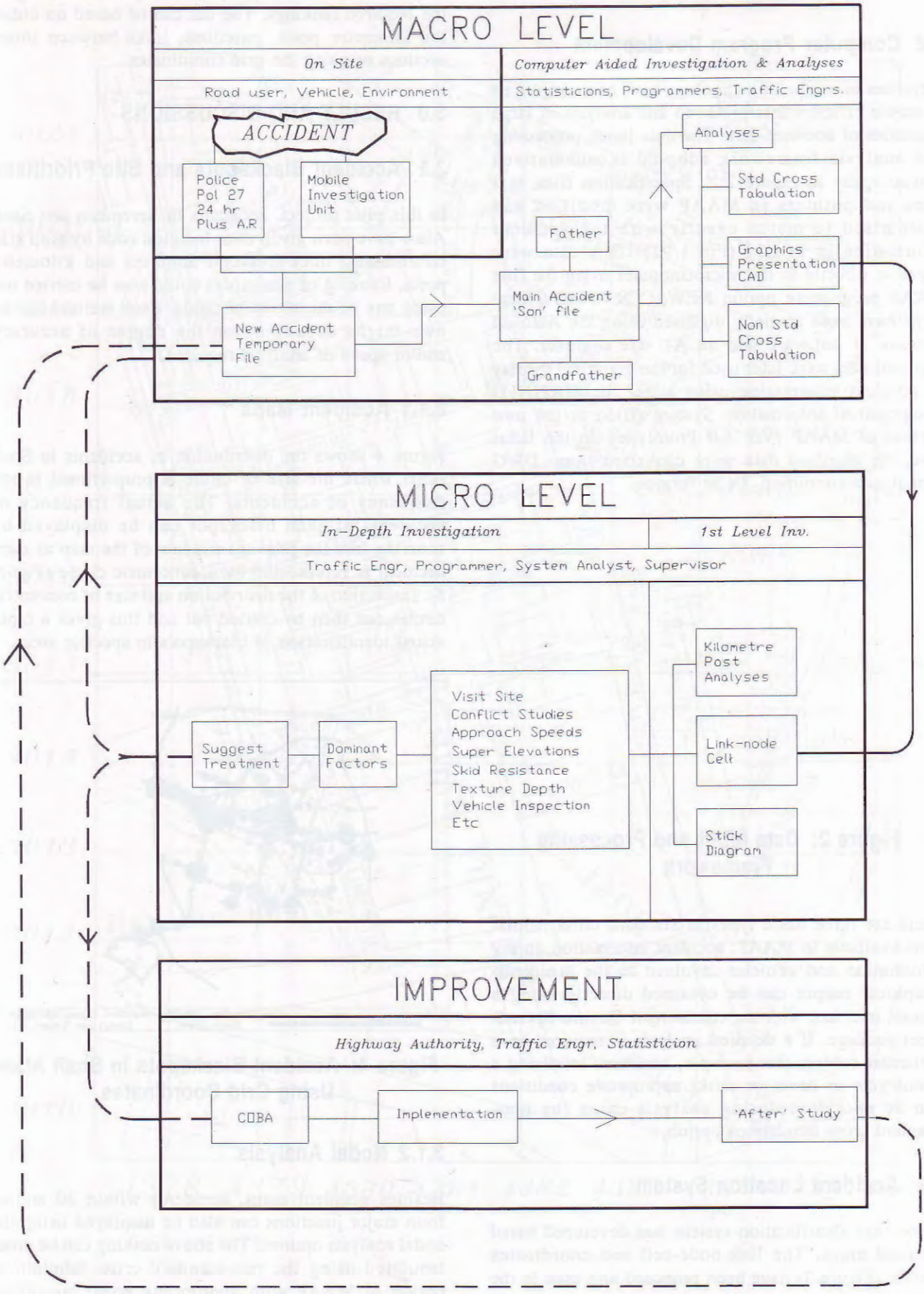

Figure 1: Blackspot Investigation and Treatment Process

investigations and relevant authorities involved are also outlined.

2.2 Computer Program Development

Advances in computer technology have been employed to enable efficient interpretation and analysis of large quantities of accident data. The data input, processing and analysis framework adopted is summarised schematically in Figure 2[(2)]. Specification files, text files and pointers in MAAP were modified and customised to match exactly with the accident information in POL27 (Pin 1/91). This data were keyed-in directly to the microcomputer using the first MAAP programme option NEWACCS. Geographical maps have been spatially digitised using the Autocad Release 11 software and an A1 size digitiser. The digitised data were later used for the graphical display of accident information using either the MAPINFO Geographical Information System (GIS) or the new version of MAAP (Ver. 5.0 Prototype). In the latter case, the digitised data were converted from .DWG format to a simplified .DCM format.

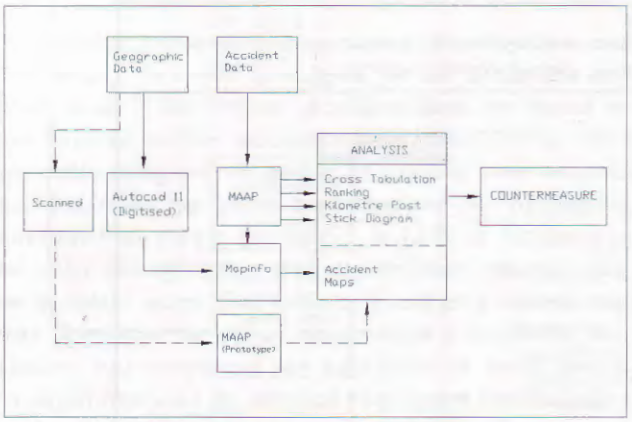

Figure 2: Data Input and Processing Framework

There are three basic types of standard cross tabulations available in MAAP: accident information, injury information and vehicles involved in the accidents. Graphical output can be obtained directly using a special interface with the commercial Quattro Spreadsheet package. If a detailed analysis is required on a particular subject (for example, accidents involving a motorcycle at dawn or dusk) appropriate conditions can be specified during analysis using the non-standard cross tabulations option.

2.3 Accident Location System

A location identification system was developed based on road maps. The link-node-cell and coordinates system (Figure 3) have been proposed and used in the pilot urban areas, while a kilometre post system has been used on the rural highways. To identify the most dangerous spots, the DETAILED ACCIDENT INVESTIGATION program option of MAAP was used to plot and list the accident blackspots according to the required rankings. The list can be based on either the kilometre posts, junctions, links between intersections or using the grid coordinates.

3.0 RESULT AND DISCUSSIONS

3.1 Accident Blackspots and Site Prioritising

In this pilot project, accidents in Seremban and Shah Alam have been given their location code by map grid coordinates, node-link-cell numbers and kilometre posts. Ranking of blackspots could now be carried out using any of the above methods. Each method has its own merits depending on the degree of accuracy and/or speed of analysis required.

3.1.1 Accident Maps

Figure 4 shows the distribution of accidents in Shah Alam where the size of circle is proportional to the frequency of accidents. The actual frequency of accidents at each blackspot can be displayed by zooming into the relevant window of the map as each accident is represented by a concentric circle (Figure 5). Inspection of the distribution and size of concentric circles can then be carried out and this gives a rapid visual identification of blackspots in specific areas.

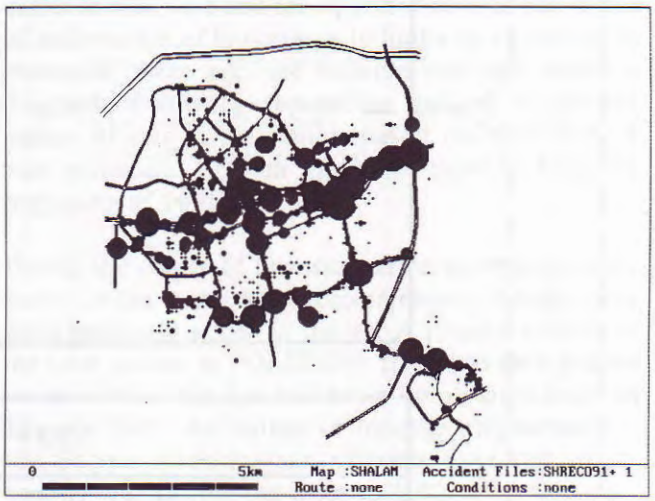

Figure 4: Accident Blackspots in Shah Alam Using Grid Coordinates

3.1.2 Nodal Analysis

Besides accident maps, accidents within 20 metres from major junctions can also be displayed using the nodal analysis options. The above ranking can be cross tabulated using the non-standard cross tabulations option of MAAP with appropriate nodal conditions specified for further ranking analysis as shown in Table 1. An accident point system based on weightings

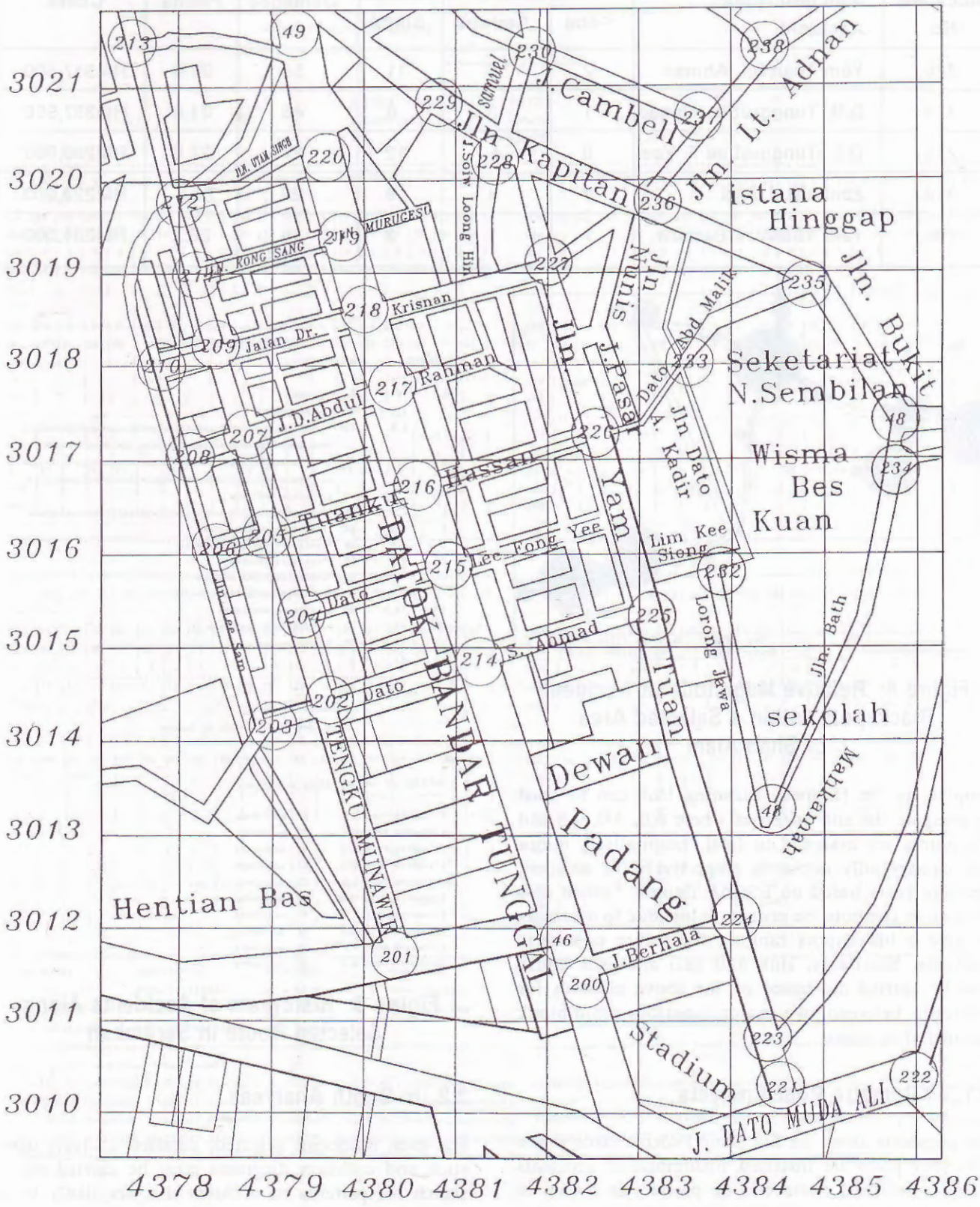

Figure 3: Location Identification System in Seremban

Table 1: Nodal Analysis in Seremban

Node Accident No.	Junction Name Accident	ACCIDENT SEVERITY			Damages	Points	Costs
		Fatal	Serious	Slight			
225	Yam Tuan/Sh. Ahmad	2	0	11	55	31.8	RM547,500
214	D.B. Tunggal/Sh. Ahmad	1	3	8	48	31.0	RM387,000
215	D.B. Tunggal/Lee F. Yee	0	4	12	27	27.0	RM280,000
313	Zaaba/D. Linggi	0	4	9	22	23.6	RM228,000
224	Yam Tuan/Jln. Berhala	1	1	3	14	20.2	RM231,000

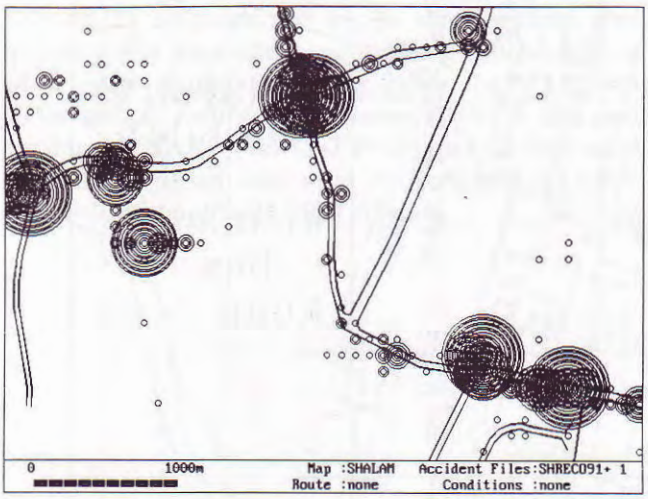

Figure 5: Relative Magnitude of Accident Blackspots within a Selected Area of Shah Alam

adopted by the Highway Planning Unit can be used to compute the site priorities where 6.0, 3.0, 0.8 and 0.2 points are assigned to fatal, hospitalised, minor and damage-only accidents respectively. In addition, accident costs based on ESCAP figures[3] could also be used to compute the economic loss due to accidents to give a blackspots ranking for future economic analysis. Similarly, link and cell analyses could also be carried out based on the above methods for stretches between two major junctions (mid-block accidents) or areas.

3.1.3 Kilometre Post Analysis

For accidents along the State and Federal roads where kilometre posts are installed, histograms of accidents along a selected route can be plotted as shown in Figure 6. Histograms of accidents within selected stretches which have high accident concentrations can also be produced by further dividing the stretch into smaller sectors, each of 100 meter length. Ranking of accidents within sections of road at 100 meter intervals can also be produced using MAAP.

```
KILOMETRES      accidents

0   - .9        7   xxxxxxx
1   - 1.9       13  *xxxxxxxxxxxx
2   - 2.9       106 *xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
                    xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
3   - 3.9       128 ******xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
                    xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
                    xxxxxxxxxxxxxxxxx
4   - 4.9       54  *xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
5   - 5.9       24  *xxxxxxxxxxxxxxxxxxxxxxx
6   - 6.9       28  *xxxxxxxxxxxxxxxxxxxxxxxxxxx
7   - 7.9       18  **xxxxxxxxxxxxxxxx
8   - 8.9       24  *xxxxxxxxxxxxxxxxxxxxxxx
9   - 9.9       31  **xxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
10  - 10.9      20  xxxxxxxxxxxxxxxxxxx
11  - 11.9      22  *xxxxxxxxxxxxxxxxxxxx
12  - 12.9      15  *xxxxxxxxxxxxxx
13  - 13        2   xx

        Total=  492

                    * Fatal     x Injury or Damage

Listing of worst 100m sections

  Kilometre Post 3.0     51  accidents
  Kilometre Post 2.1     50  accidents
  Kilometre Post 2.0     46  accidents
  Kilometre Post 3.1     41  accidents
  Kilometre Post 4.8     23  accidents
  Kilometre Post 11.2    19  accidents
  Kilometre Post 3.2     17  accidents
  Kilometre Post 8.0     17  accidents
  Kilometre Post 9.6     16  accidents
  Kilometre Post 6.4     14  accidents
```

Figure 6: Histogram of Accidents Along Selected Route in Seremban

3.2 In-Depth Analyses

For each blackspot selected, detailed analysis using stick and collision diagrams must be carried out to search for patterns of accident that are likely to be reduced by engineering treatment. Whenever possible, site studies should be organised to collect supplementary data such as traffic conflicts, flow, origin-destination, speeds etc in an attempt to obtain further indications of factors leading to road user conflicts which in some events have resulted in accidents.

Print Date: Mon 04-05-1993

Universiti Pertanian Malaysia

STICK DIAGRAM ANALYSIS

ACCIDENT RECORD FILES: N00225
CONDITIONS SET: Node 1 = 225
Node 2 = 000

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
BLN	09	09	09	12	08	08	08	10	10	10	01	11	11	11	11	11	03	03
TRH	07	19	30	02	01	10	16	13	20	23	03	07	11	15	29	30	04	09
HRI	7	5	2	2	5	7	6	1	1	4	5	5	1	6	6	7	2	7
MSA	16	10	12	20	15	09	15	09	18	09	09	21	17	01	20	11	13	12
PEJ																		
PRH	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	I	D
BK	BK	BK	BK	BK		BK	BK	BK	BK	BK	BK	BK	BK	BK	BK	BK	BK	BK
>*<										>*<								
>*>															>*>	>*>		>*>
>*|																	>*|	
ANI																		
OT					OT													
SS	SS		SS	SS		SS			SS	SS			SS					
D&D																		
DRK																		

	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54
BLN	02	03	03	03	03	03	04	04	04	05	05	06	06	06	07	08	08	08
TRH	29	10	14	15	19	26	01	06	20	02	08	14	27	29	24	05	23	30
HRI	7	3	7	1	5	5	4	2	2	7	6	1	2	4	6	4	1	1
MSA	12	08	00	15	21	18	17	16	13	10	07	16	10	17	12	11	11	14
PEJ														PEJ				
PRH	D	D	D	I	D	D	D	D	D	D	D	I	D	I	D	D	D	I
BK	BK	BK	BK	BK	BK	BK	BK	BK	BK	BK	BK	BK	BK	BK	BK	BK	BK	BK
>*<																	>*<	
>*>	>*>	>*>	>*>															>*>
>*|								>*|										
ANI																		
OT					OT	OT												
SS			SS			SS	SS											
D&D					D&D													
DRK																		

	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
BLN	03	04	04	04	04	06	06	05	05	05	07	07	01	01	02	02	02	02
TRH	27	05	05	12	30	03	09	03	10	30	03	11	05	14	03	06	10	12
HRI	4	6	6	6	3	2	1	6	6	5	4	5	1	3	2	5	2	4
MSA	15	20	10	21	17	12	16	13	16	13	20	20	13	16	01	18	15	19
PEJ			PEJ					PEJ										
PRH	D	D	I	D	D	D	D	I	D	D	D	I	D	D	D	D	I	F
BK	BK	BK	BK	BK	BK	BK	BK	BK	BK	BK	BK	BK	BK	BK	BK	BK	BK	BK
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ANI																		
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SS			SS	SS		SS			SS			SS	SS				SS	
D&D																D&D		
DRK																		

	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72
BLN	09	09	10	10	10	10	10	11	11	11	11	11	12	12				
TRH	06	06	06	08	13	13	23	15	16	09	22	14	22	11				
HRI	1	1	3	4	3	3	6	1	2	2	1	7	3	6				
MSA	23	13	13	14	11	11	14	08	06	11	14	20	17	22				
PEJ								PEJ						PEJ				
PRH	D	D	I	D	D	D	D	I	D	D	D	D	D	F				
BK	BK	BK	BK	BK	BK	BK	BK	BK	BK	BK	BK	BK	BK	BK				
>*<																		
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ANI																		
OT																		
SS		SS		SS		SS			SS		SS							
D&D									D&D									
DRK																		

BLN= BULAN TRH= TARIKH HRI= HARI MSA= MASA
PEJ= PEJ.KAKI PRH= KEPARAHAN BK = BAIK >*<= HEADON
>*>= REAR END >*|= SIDE ANI= ANIMAL OT = OVERTURN
SS = SIDESWIPE D&D= SUBUHSENJA DRK= DARK

Stick Number = Accident Code Number:-

1 =021139 2 =022084 3 =023430 4 =030387 5 =019100 6 =019730 7 =020055 8 =025006
9 =025632 10=025898 11=000253 12=027504 13=027706 14=028153 15=029898 16=030053
17=005640 18=006068 19=007627 20=008423 21=008420 22=009096 23=010276 24=012604
25=013342 26=010386 27=010793 28=012139 29=015955 30=016991 31=000659 32=001813
33=004612 34=005113 35=005466 36=005626 37=007209 38=008200 39=008617 40=008743
41=009150 42=009674 43=010265 44=010452 45=011281 46=012372 47=012970 48=016538
49=017877 50=018113 51=021177 52=023359 53=026505 54=027712 55=028721 56=028797
57=033104 58=033357 59=034229 60=034232 61=035419 62=037828 63=037829 64=037219
65=038520 66=037699 67=041581 68=040492

Figure 7: Stick Diagram at Node 225 Seremban

3.2.1 Example of an In-Depth Analysis at Node 225 Yam Tuan/Sheikh Ahmad Junction

Using the available database of 1991 and 1992, it can be seen from Table 1 that the worst blackspot in the Seremban pilot area is node 225. This site is a T-junction on the North-South Federal Road F0001 passing through the middle of Seremban town. The majority of accidents at this site occurred on the major one-way road as shown in the stick and collision diagrams in Figures 7 and 8. Side swipe accidents involving vehicles merging from the side road, Jalan Sheikh Ahmad, constitute the majority of collisions and a total of three injury and one fatal accidents were reported. Another major type of accident involving injury arises from vehicle-pedestrian collisions (one fatal and four injuries) and, at present, there are no special facilities for pedestrians to cross this busy one-way street.

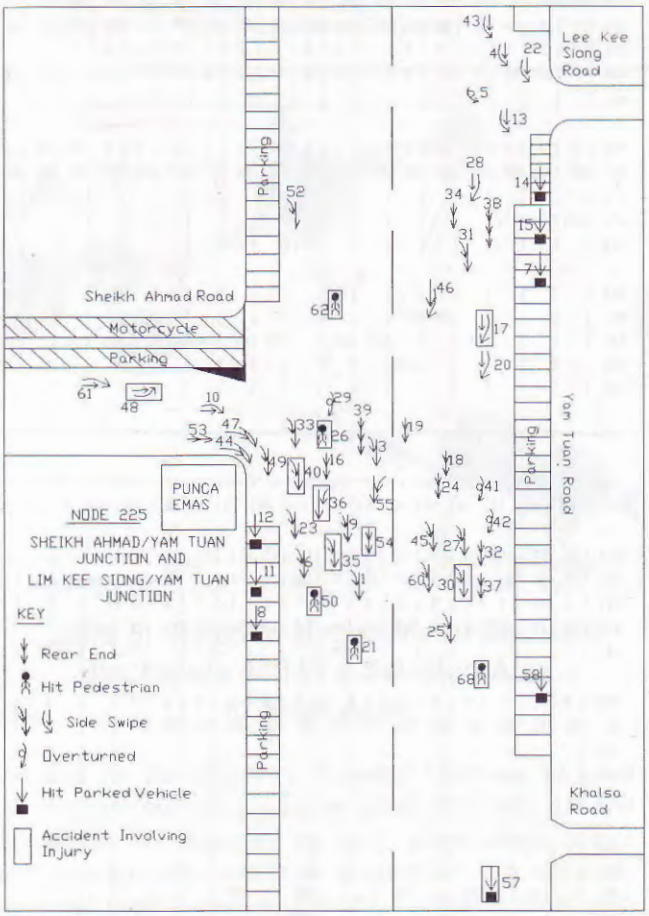

Figure 8: Collision Diagram at Node 225 Seremban

A one-day site study was carried out to capture the near misses, approach speeds, vehicle and pedestrian flows and their manoeuvres. The vehicle and pedestrian flow counts are shown in Figure 9 and the conflicts recorded over the six-hour period are summarised in Table 2. It can be seen that there are relatively large numbers of pedestrians crossing the busy Jalan Yam Tuan (maximum of 890 peds/h) and yet no crossing facilities have been provided. It can be seen also that the merge type of conflict is most prevalent immediately after the Jalan Sheikh Ahmad junction. This is due to the high merging flow which tends not to give way to vehicles from the major stream, often crossing to the left-hand side to Jalan Khalsa as soon as they have joined the main road. Pedestrian conflicts are relatively frequent especially when business activity begins. Approach speeds along the major road were found not to be excessive with a mean speed of 30 km/h and 85th percentile speed of 37 Km/h respectively (Figure 10).

3.3 Proposed Countermeasure

In view of high conflicts amongst the merging and through vehicles, strategy to minimise the number of opportunities for conflicts by segregation would be the best option. A raised pavement extension is proposed to begin the segregated lane in the position as shown in Figure 11. A solid delineator is required down-stream of Jalan Sheikh Ahmad so that vehicles joining the main stream will have to form a single file. The channelisation should be extended beyond Jalan Khalsa so that the abrupt crossing conflicts observed will not occur.

Table 2: Traffic Conflicts at Node 225, Seremban

Conflict Manoeuvre Type	Number of Slight and {Serious} conflicts at junction of J. Yam Tuan/J. Sheikh Ahmad in hour beginning:						6-hour Total
	09:00	10:00	12:00	13:00	16:00	17:00	
Merging	34 {1}	29 {2}	38 {3}	39 {1}	37	38 {1}	215 {8}
Pedestrian	0	1	6 {1}	8 {1}	2	5	22 {2}
Rear-end	6	2	7	8	4	6	33
Crossing	4	5	3	1	1	2	16

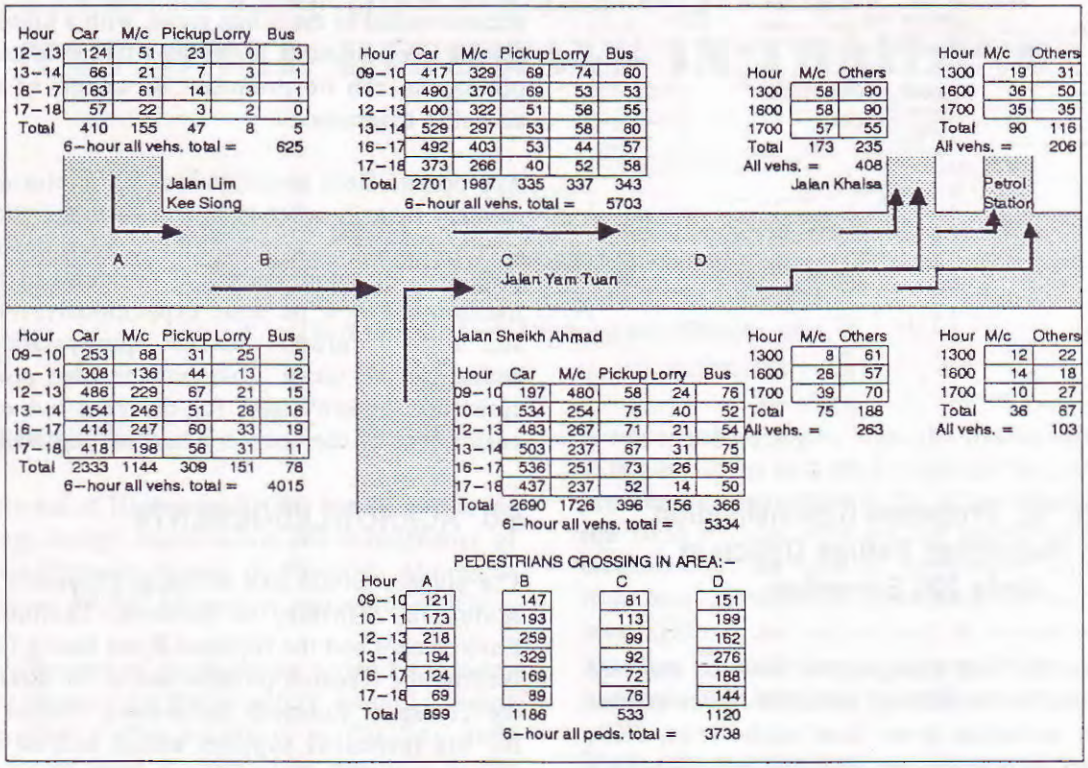

Figure 9: Pedestrian and Flow Counts at Node 225 Seremban

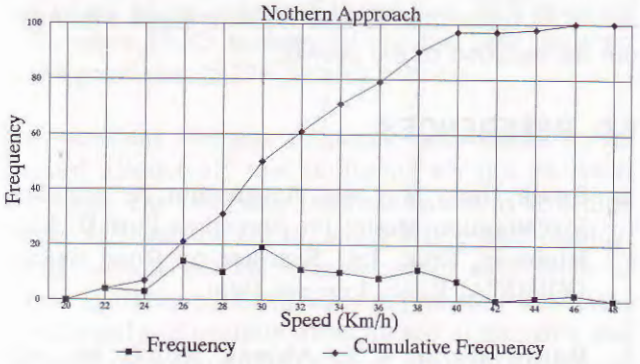

Figure 10: Distribution of Approach Speed at Node 225 Seremban

In order to reduce pedestrian-vehicle conflicts, a pedestrian crossing facilities is strongly recommended. A pedestrian bridge with appropriate guard railing is required to provide a safe crossing facility and to channelise pedestrians to the bridge. Alternatively, if the construction cost of the bridge is too high, a pedestrian refuge may be incorporated in this channelisation scheme as shown in Figure 12. Large road studs along the boundary line of the hatch area and direction arrows on the refuge are suggested to reduce the likelihood of collisions with the new refuge. This arrangement will enable more space to be available for motorcycle parking in the side roads and is, in fact, likely to be more popular with pedestrians than a bridge.

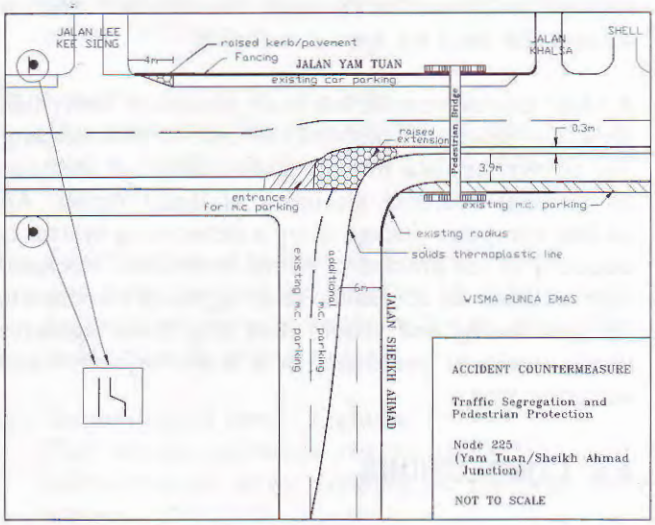

Figure 11: Proposed Channelisation with Pedestrian Bridge at Node 225 Seremban

3.4 National Accident Database

Following the success of the pilot project in implementing a flexible diagnosis system and the launching of the new accident form POL27 (Pin 1/91) in January 1992, it was decided in early 1992 to extend the system to the national level. A downloading transcription programme was written in mid 1992[4] and tested with the national accident data available on mainframe computer at Police Headquarters, Bukit Aman. This mainframe computer is used to store all

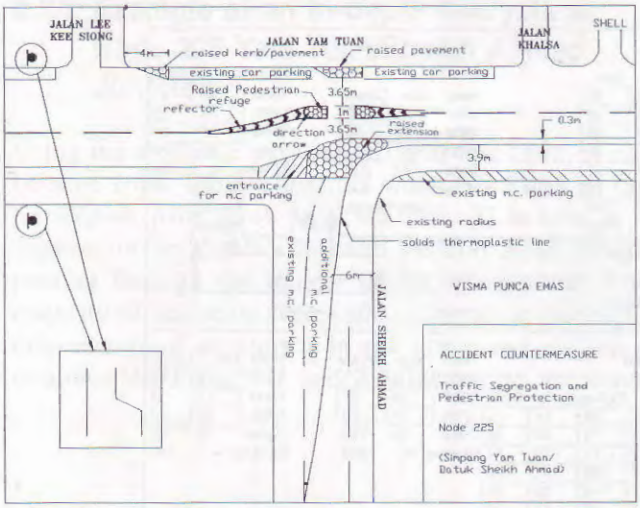

Figure 12: Proposed Channelisation and Pedestrian Refuge Option at Node 225 Seremban

national data and was designed to produce standard accident tables for the national statistics. Since queries on accident statistics from local authorities, JKR, MKJR etc are frequently non-standard and often very specific, this has now necessitated the writing of special Cobol programs by police personnel to meet these requests. The police are therefore very keen to use the diagnosis system, MAAP, to enable them to respond much quicker to such non-standard queries without the need for special software.

A '386' microcomputer has been purchased under this project primarily to perform the task of downloading and converting data formats and to carry out analyses of national accident statistics at Bukit Aman. An on-line computer linkage using a networking system is currently in the process of being introduced. Accident data will soon be accessible to all agencies responsible for road safety and should thus help these agencies tackle accident problems in a more objective and scientific way.

4.0 CONCLUSIONS

An accident diagnosis system and blackspots prioritising system have been developed and tested for diagnosing accident problems in the pilot project areas. An accident treatment framework has been demonstrated which provides a working model for full implementation throughout Malaysia. The new accident form, POL27 (Pin 1/91) has been redesigned and is now in use nationwide (since January 1992). The computer analysis system developed enables a thorough analysis not only on a macro scale but also on specific blackspots. A hazardous location identification system based on accident maps, link-node-cell system and coordinates has been recommended in the urban areas, with a kilometre post system for the rural highways. In-depth analyses of blackspots can be produced by means of stick and collision diagrams.

Appropriate field investigations for capturing supplementary data in order to obtain further indications of events leading to accidents have been demonstrated. Diagnosis of actual causes of accidents at a problem location can now be done expeditiously, more easily and more accurately so that appropriate remedial action can be taken. This process also provides the essential "before" data for carrying out qualitative evaluations of the countermeasures implemented.

5.0 ACKNOWLEDGEMENTS

The authors would like to thank Universiti Pertanian Malaysia, Ministry of Science, Technology and Environment and the National Road Safety Council for funding the research projects and to Dr. Brian Hills of the Transport Research Laboratory, United Kingdom for his technical support which helped make the project possible. The authors are also grateful to the Royal Malaysian Police; in particular, ACP Supian Ahmad, ACP Abdul Halim, ACP Syed Abdul Rahman, ASP Acryl Sani and Insp. Roslan, and also to Dr. Aminuddin Adnan of Pengurusan Lebuhraya Berhad and to all research assistants for their support throughout the duration of the project.

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TRAFFIC SAFETY PROGRAM FOR NATIONAL HIGHWAYS IN THAILAND

by

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1. INTRODUCTION

The Department of Highways (DOH) is responsible for the planning, design, construction and maintenance of the National Highway System of Thailand. At present there are about 55,000 kilometers opened to traffic.

As the development of the highway network increases so does the concern for traffic safety. During the past few years, road traffic accidents in Thailand have continued to increase considerably, not only in the number of accidents, but also in the number of casualties. The police accident statistics, from 1981 – 1991 showed that accidents increased 2.5 times and death rates doubled. The latest accident statistics show that of the 44,000 accidents in one year, 82% occurred in Bangkok (1043 persons killed) and 18% occurred in the provinces (5,276 persons killed).

The accident analysis indicates that human errors caused almost all the accidents on the national highways. The 1991 data show the causes as 70% high speed, 11% sudden cut in, and 7% improper passing. While vehicle defects were found in only 3-8% of cases, DOH thought that roadway factors contribute significantly, especially substandard alignments and insufficient safety facilities at specific locations. Therefore three principal approaches of engineering, enforcement and education have been contained in the DOH highway safety programme, namely;

* Roadway Engineering Improvement
* Highway Police's Stringent Enforcement
* Safety Driving Campaign

2. ROAD ENGINEERING IMPROVEMENT PROGRAMME

This programme aimed to improve the existing black sports and upgrade the general facility. DOH identifies black spots by using statistical analysis of available accident data and from public complaints. The statistical approach is based on casualty-accident rate versus traffic volume on a road section. When the accident rate is higher than the overall average, then it is considered as a hazardous section and engineers are sent to investigate the site and discuss with the field district officers the selection of counter measures. In the case of complaints which may be from local government, mass media or traffic surveys, investigations are carried out to determine the justification for inclusion in the programme and, where justified, to determine appropriate counter measures.

There are six black spot counter-measures.

i) **Improvement of roadway geometry**
The work includes improvement of geometric design, construction of channelized islands, installation of traffic control devices and/or safety facilities.

ii) **Construction of bicycle lane**
The work includes construction of new bicycle lane or improving the existing road shoulder for bicycles.

iii) **Construction of pedestrian bridge**
The work includes construction of bridges over highway or tunnels under highway, to enable pedestrians to cross safely

iv) **Installation of Street Lighting**
The works includes the construction and installation of street lighting on roadway and bridges.

v) **Installation of Traffic Signals**
The work includes the construction of new traffic light signals and up-grading of existing signals.

vi) **Construction of Guard Fences**
The work includes the construction all kinds of guard fences and concrete barriers to prevent vehicles from leaving the roadway.

Since 1987 DOH has systematically planned and monitored the remedial black spot programme, and the World Bank also supported foreign exchange component for 1988 to 1990 works. The expenditures and budgets of this programme are shown as follows.

TYPE OF WORKS	EXPENDITURE AND BUDGET (million Baht)						
	1987	1988	1989	1990	1991	(1992)*	(1993)**
Geometric Improvement	3.730	12.318	28.697	9.000	2.390	11.471	30.000
Lighting & Signal	22.332	55.512	87.401	30.000	85.024	54.235	144.000
Guard Fence	25.953	18.365	42.877	10.000	31.104	28.676	60.000
Bicycle Lane	0.880	2.144	1.100	0.000	3.601	4.010	4.500
Pedestrian Bridge	0.000	1.170	13.200	9.900	24.892	22.270	51.000
TOTAL	**52.895**	**89.510**	**173.275**	**58.900**	**157.011**	**120.663**	**289.000**

*Note:– * allocated budget, ** requested budget*

Apart from the black spot programme, DOH has also improved and upgraded the national highways for safer driving. The most important project has been the paving of road shoulder which are within 50 kilometers from provincial capitals where motorcycles are highly used, to provide a safe driving lane for motorcycles and provision for pedestrians and car parking in the built up areas. The project started in 1992 with an annual budget of about 1.3 million Baht and it is expected that all proposed sections of about 20 thousand kilometers will have paved shoulders by the year 2001.

3. HIGHWAY POLICE'S STRINGENT ENFORCEMENT PROGRAMME

The Highway Police was established in 1961 under the organization of the Police Department. It's main duties are to regulate and enforce traffic on the national highway and to promote the welfare of motorists.

DOH has given directives and policies for Highway Police's traffic operation tasks, and administers the budgets for their development of facilities and forces. At present there are about two thousand policemen to look after 14 thousand kilometres of highways. They have 584 vehicles patrolling 24 hours a day over the responsible sections. During recent years DOH allocated budgets to the Highway Police as follow:–

YEAR	BUDGET (million Baht)
1988	257
1989	266
1990	275
1991	333
1992	360

As enforcement can reduce road traffic accidents the Highway Police launched a stringent enforcement programme which aims at maximum fines for violating the following regulations:

* Speeding
* Careless overtaking
* Driving in the passing lane on the four-lane divided highways
* No head beam at night
* Emergency parking without warning signs or signal at night
* Violating stop sign.

A great many serious accidents were caused by drugged drivers as such the Highway Police has attempted to destroy the dangerous source, they arrested many cases last year.

4. SAFETY DRIVING CAMPAIGN

Road users play the most important part in traffic accidents. Careless driving by violating road rules and traffic signs are found everywhere and drugged and drunk drivers create the most tragic accidents. In addition, a great many drivers know how to drive but are unable to manoeuver their vehicles in the traffic stream. The National Safety Council therefore urges all concerned agencies to promote safety driving campaigns. DOH assigns the Public Relation Unit to be responsible for this programme. The Unit coordinates with the Highway Police, Land Transport Department, Provincial Government and other private firms to organize road safety campaigns. Its activities are distributing accident information on national highways, traffic sign leaflets and posters, instruction sheets for safety driving, and so on. The Unit has routine announcement on national highway conditions to the public via the mass media, and any emergency information can also be inquired.

5. CONCLUSION

The Department of Highways has invested considerable funds towards accident prevention and had control the tragedies at least to some degree. Because traffic accidents are caused by many factors created by man, vehicle and environment, it requires all concerned agencies and users to co-operate in fighting the problem. Highway design standards and traffic safety facilities must be improved as well as vehicle inspection must be reliable. The drivers have to be screened before allowing them to drive on public roads.